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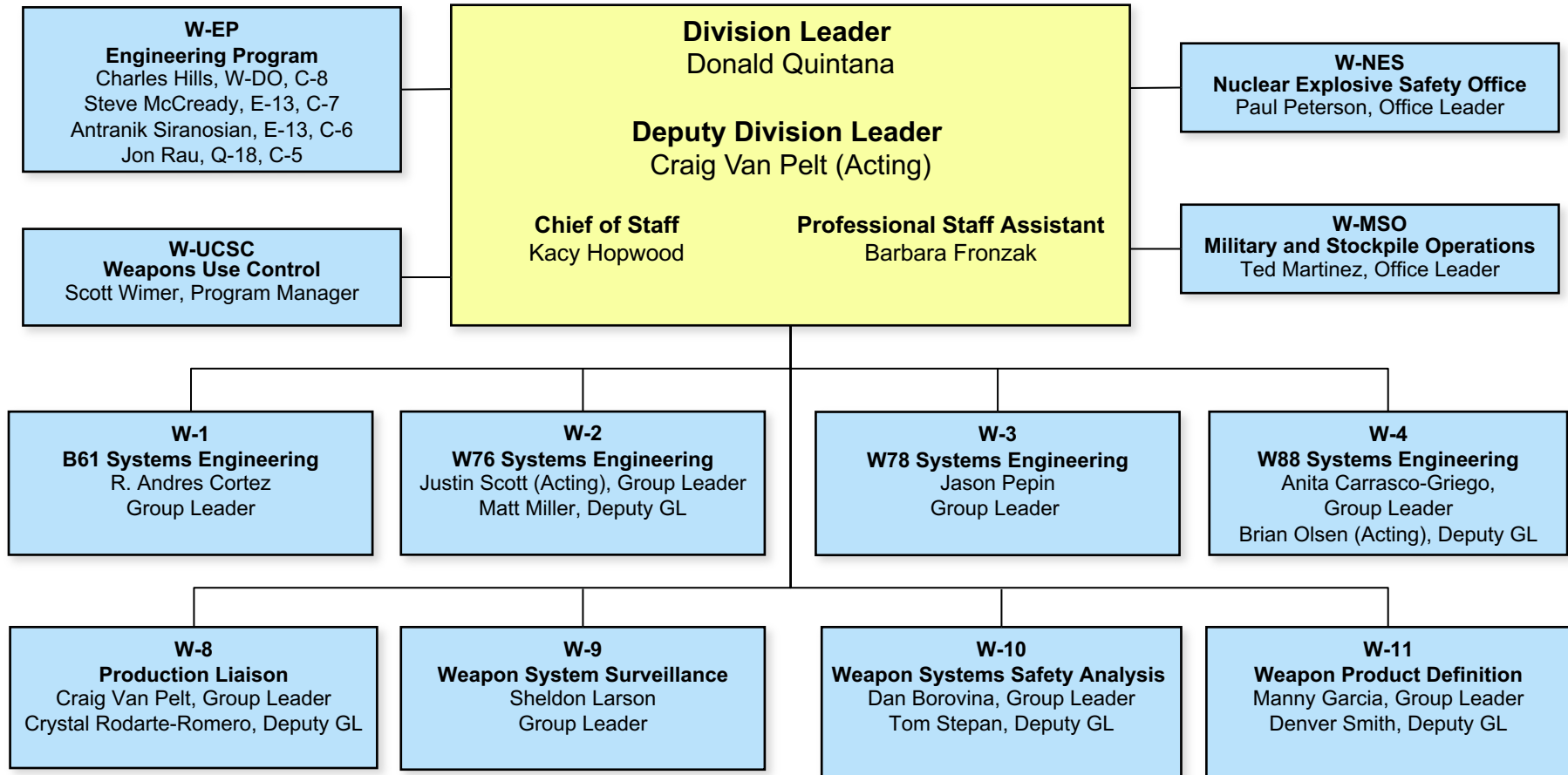
Delivering science and technology  
to protect our nation  
and promote world stability

## Weapons Overview

Don Quintana-Division Leader Weapon  
Systems Engineering (W)  
Summer 2020  
LA-UR-20-xxxx



# W Org Chart



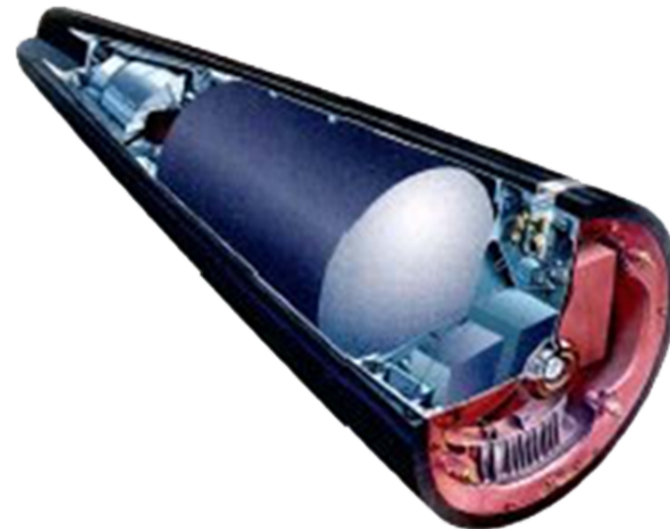




# Navy Weapons

## W76

- **Entered Stockpile:** 1978
- **Variants:** Mod 0, 1, 2
- **Deployed from:** Navy Ohio Class SSBN
- **Fact:** Cornerstone of our SLBM force



# Navy Weapons cont.

## W88

- **Entered Stockpile:** 1988
- **Variants:** 0
- **Deployed from:** Navy Ohio Class SSBN
- **Fact:** No major changes over 30-year timeframe



# Navy Deployment System

## Ohio-class SSBN

- **Builder:** General Dynamics Electric Boat Division
- **Date Deployed:** Nov 11, 1981 (USS Ohio)
- **Propulsion:** One nuclear reactor, one shaft
- **Length:** 560 feet (170.69 meters)
- **Speed:** 20+ knots (23+ miles per hour)
- **Crew:** 15 Officers, 140 Enlisted (77days)
- **Armament:** 20 tubes for Trident II, four torpedo tubes
- **Current Fleet:** 14





# Air Force Weapons

## B61

- **Entered Stockpile:** 1968
- **Variants:** Mods 3,4,7,11
- **Deployed from:** U.S. Air Force and NATO bases
- **Fact:** Oldest and most versatile weapon



# Air Force Deployment System

## B-2

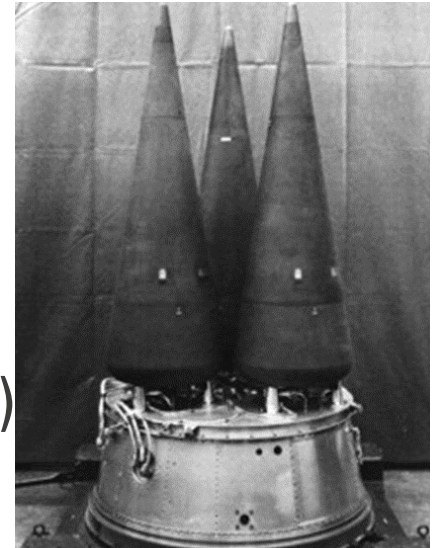
- **Builder:** Northrop Grumman
- **Entered Service:** 1989
- **Current Fleet:** 20
- **Payload:** 40,000 lbs
- **Crew:** 2



# Air Force Weapons

## W78

- **Entered Stockpile:** 1979
- **Variants:** 0
- **Deployed from:** U.S. Air Force
- **Fact:** Can be MIRV'd (as shown at right)



# Air Force Deployment System

## Minuteman III

- **Builder:** Boeing
- **Entered Service:** 1970
- **Currently Deployed:** approx. 400
- **Fact:** The Minuteman III was the first U.S. Intercontinental Ballistic Missile (ICBM) that could deliver Multiple Independent Reentry Vehicles (MIRVs) to a target. The missile can hold up to three warheads, which can strike different targets miles away from each other.



# Future of the Stockpile

## Maintaining the stockpile overview

- B61-12 Life Extension Program
- W76-1/2 Life Extension Program
- W88 Alteration 370

# Future of Deployment Capabilities

## Future deployment systems

- B-21 Raider, Mid-2020s
- Ground Based Strategic Deterrent (GBSD), late 2020s
- Long Range Standoff Weapon (LRSO), early 2030
- B-52H, Life Extension out to 2050
- Columbia Class SSBN, early 2030



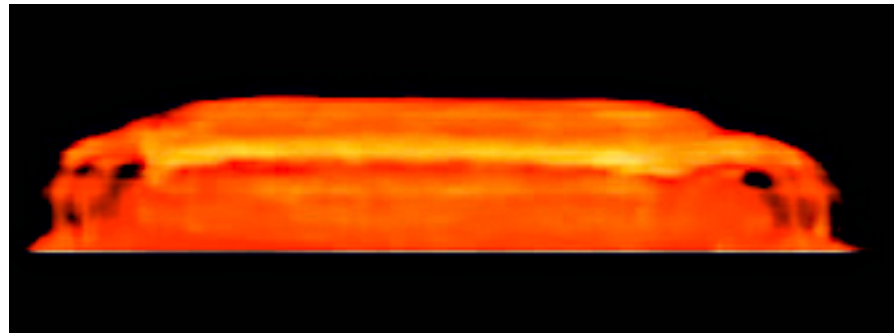
# LANL Continues to Perform Annual Assessments of Four Weapon Systems and is Involved in Life Extension Programs

- Stockpile stewardship, a science-based program of experiment and simulation that replaces underground nuclear testing, and an Annual Assessment process that requires the Laboratory directors at Los Alamos, Livermore, and Sandia to complete an assessment of the safety, reliability, and performance of each nuclear weapon type in the active stockpile.
- LANL is responsible for the W76, W78, W88 and B61 weapon systems' nuclear explosives packages.
- Some weapons must undergo Life Extension Programs that follow a formal process for certification prior to introduction to the stockpile.



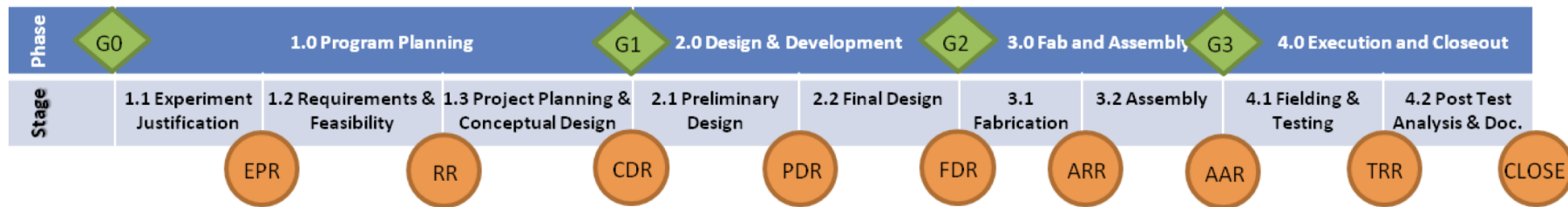
# The Certification Process for the LEPs is Based upon Engineering and Physics Assessments

- Engineering Technical Basis Qualification.
  - System Qualification.
    - Requirements from STS, MCs, ES, CDs, ICDs.
  - Production Qualification.
    - PA Production Activities.
    - Guarantee that what was tested was fabricated by the PAs will be deployed in the stockpile.
- Physics Assessment
  - Incremental Approach.
  - Small Scale Experiments.
  - Hydrodynamic Experiments.
  - Modeling and Simulation.





# System Qualification Test Process



Stage Gate Express- Ex. LTs, Subsystems  
(Less Stages)

Stage Gate Lite- Ex. LTs, Components, Materials,  
Subsystems  
(Few Stages)



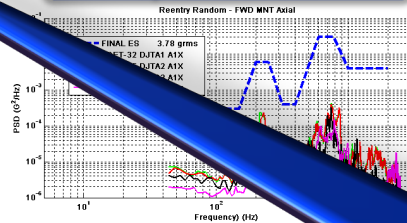
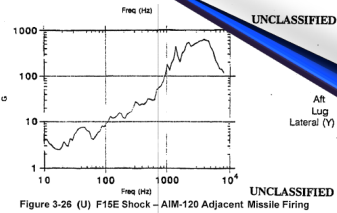
# System Qualification Approach

## System-level STS requirements

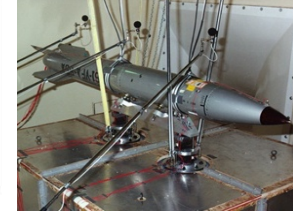
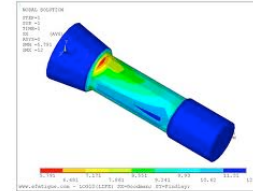
Qualify system to STS and strive to improve as needed

Integrate test and analysis to maximize confidence and breadth of technical basis

## Environmental and Test Specifications



## Physical and *Computational* simulation



## System-level validation testing



Rigorous traceability to system-level requirements is paramount; test/analysis combined to demonstrate qualification

Quantified component margin assessment

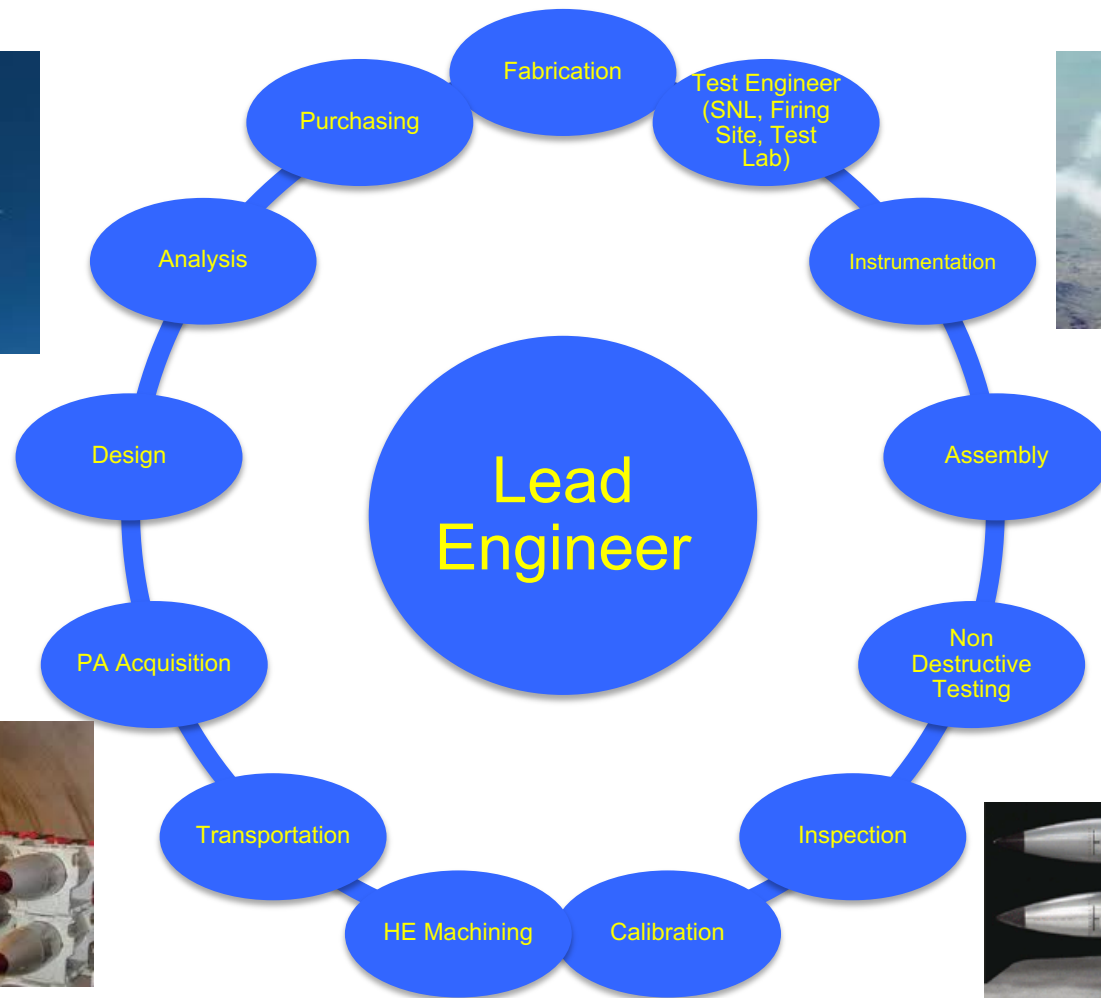
## Component-level test and analysis



**TECHNICAL BASIS QUALIFIED**

**Comprehensive approach to qualification**

# Lead Engineer Interactions



# Overview of Typical System Qualification Activities

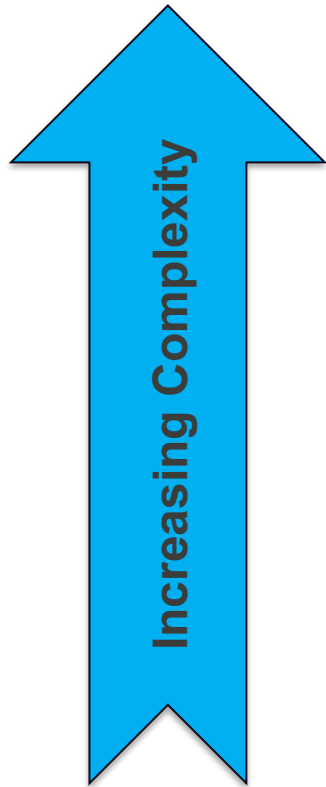
- Need to ensure All Up Round (AUR) performance:
  - Reliability in normal environments.
  - Nuclear safety in abnormal environments.
  - Use control functionality tests in normal environments.
  - Understand and prepare for abnormal/hostile environments
- Normal environments addressed include:
  - Mechanical (vibration, shock, acoustics); thermal (hot and cold extremes, thermal shocks, humidity extremes); EM-lightning (EMP, EMR, lightning, etc.); Materials Compatibility; Flight (captive carry & drop); Radiation addressed at component level.
- Abnormal environments addressed are:
  - Thermal: Fire.
  - Mechanical: Impact, fragments, crush.
  - EM: Lightning.
- Hostile



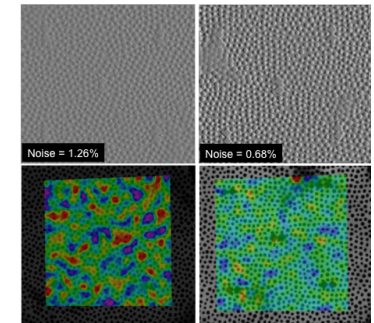
***System qualification activities focused on normal, abnormal and hostile environments – typical of NNSA programs***



# Certification Requires an Incremental Approach from Small Scale Development and Local Tests to Full System Flight Tests



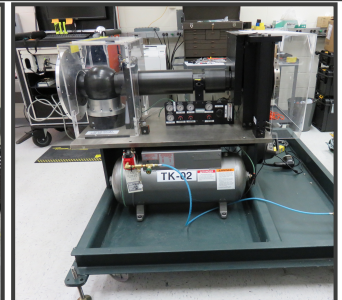
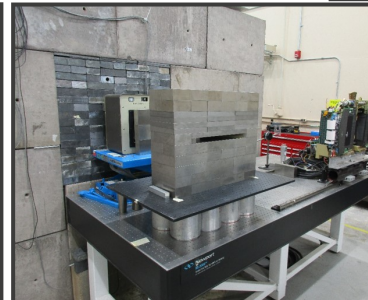
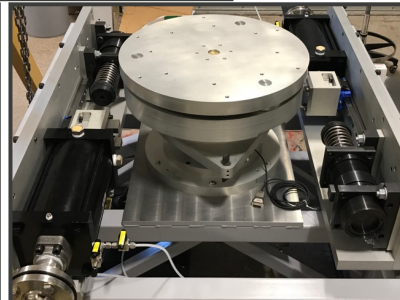
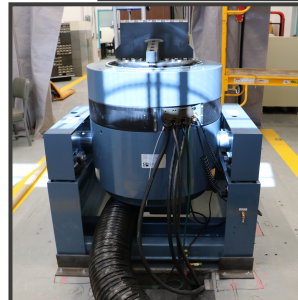
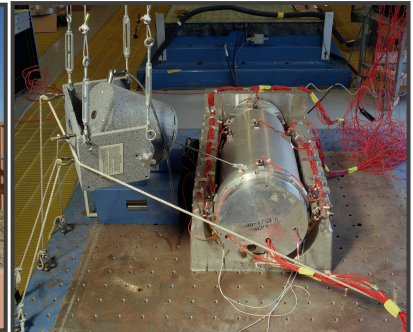
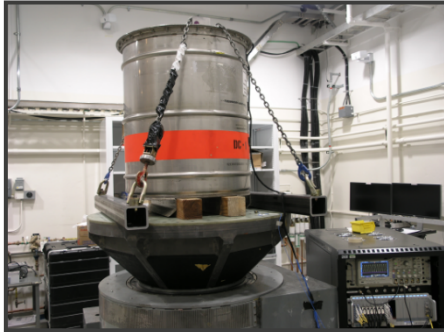
- Flight Tests
- Hydros
- Joint Tests
- Local Tests
- Developmental Tests



***Tests inform qualification test conclusions, as well as predictive engineering and physics model confidence and expansion***

# Engineering System Qualification Test Activities- Normal Environments Capability Examples

- System and Subsystem Level Tests for Re-entry Systems



Thermal

S&V

Angular Acceleration

Radiography

Air Bearing

# Questions?

